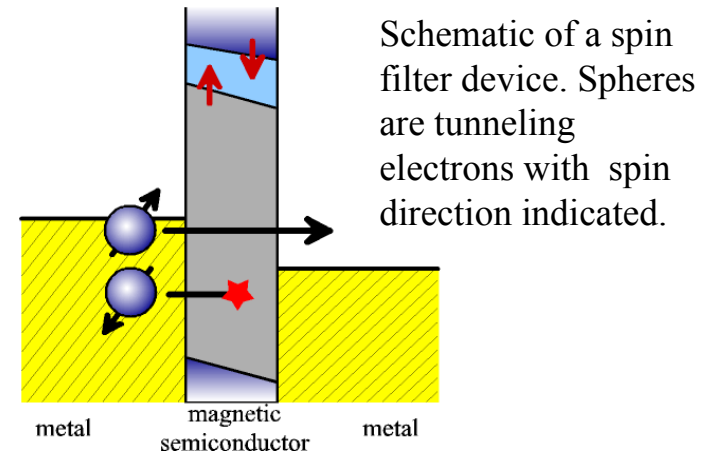


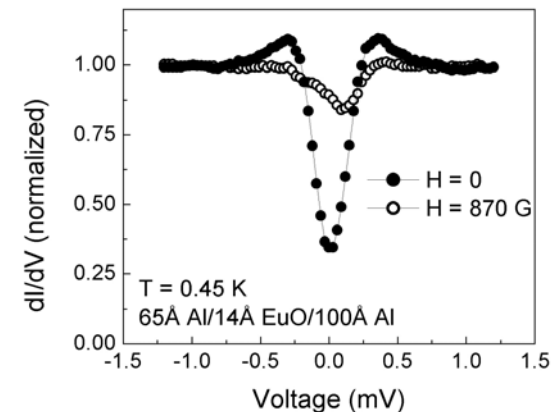
Spin Polarized Tunneling Studies in Transition Metals, Alloys and Heavy Fermions

Jagadeesh S. Moodera, Mass. Inst. of Tech., DMR-0137632

Electronics based on magnetic materials and phenomena is a new and growing field responsible for many innovations around us. Faster, larger, and cheaper hard disks are a visible result. The effects responsible for these improvements began as fundamental research, only later finding application. Developing even more novel effects is vital to the future of communications, data storage, and computation. Reprogrammable (on the fly) spin logic processors for highly flexible computing are a near term possibility. At its heart, magnetic electronics rely on efficient manipulation of the electron spin. A magnetic electronic “spin filter” allows only 1 of the two spin types to pass. Also under investigation are atomic-scale “tailoring” of materials to create novel properties ideally suited for new nanotechnologies, and exotic heavy-Fermion compounds, whose potential for application are yet unknown.



Conductance characteristic for such a device. The four-peaked asymmetric curve in a magnetic field (open symbols) indicates filtering.



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Education:

In total five graduate students (2 here and additionally 3 visiting students) have participated in the program and have presented papers at international conferences. Two of the undergraduates have gone on to graduate study. One of the undergraduates not only won their departmental best BS thesis award, but also presented a paper at an international conference.



An undergraduate student (left) and postdoc (right) take a break as the PI looks on.

Outreach:

Ten high school students participated in the last three years of the research program. The students have won many scientific competitions, such as those sponsored by Intel and Siemens, including top awards, and proceeded to state-level school competitions. Two of the female high school students have taken up physics majors in college, one of whom continued her research in Ireland for a summer. Most of these HS students have been admitted to top schools such as MIT, Harvard, Stanford etc.